



February 3, 2017

Via ECFS

Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: Wireless E-9-1-1 Location Accuracy Requirements
PS Docket No. 07-114

Dear Ms. Dortch:

In accordance with Section 20.18 of the rules of the Federal Communications Commission, Sprint hereby files the attached initial implementation plan and progress report in the above-referenced docket.¹

Please contact the undersigned if there are questions concerning this filing.

Sincerely,

/s/ Ray Rothermel

Ray Rothermel
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Attachment

¹ See 47 C.F.R. § 20.18(i)(4).



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Under the rules of the Federal Communications Commission (“Commission” or “FCC”), nationwide wireless carriers are required to generate either a Dispatchable Location (“DL”) or X/Y location information within 50 meters for a certain percentage of wireless calls to 9-1-1 within specific timeframes. (See FCC, *Fourth Report & Order on Wireless E911 Location Accuracy Requirements* (rel. Feb. 3, 2015)). Dispatchable Location solutions provide the verified street address, plus additional location information from the planned National Emergency Address Database (“NEAD”) that will help locate, with increased accuracy, a wireless device placing a call to 9-1-1. By developing Dispatchable Location solutions, wireless providers are leveraging evolving wireless technologies, such as WiFi and Bluetooth, to help improve the ability of first responders to efficiently and safely respond to wireless 9-1-1 callers that may be located indoors.

The four nationwide wireless carriers, including Sprint, agreed to fund and implement a NEAD containing the locations of wireless access points to help provide a Dispatchable Location to public safety answering points (“PSAPs”). The National Emergency Address Database LLC (“NEAD LLC”) was formed as an independent company to administer and operate the NEAD consistent with the FCC’s rules. The NEAD LLC then selected the Alliance for Telecommunications Industry Solutions (“ATIS”) as the program manager for the NEAD. The NEAD LLC initiated a competitive bidding process to select a suitable vendor to develop and operate the NEAD. West Safety Services (“West”) was selected in October 2016 to develop and operate the NEAD platform. As the primary technology vendor for the NEAD, West has contracted to implement the NEAD platform in strict accordance with the FCC rules, including relevant technical standards and privacy and security requirements. The NEAD LLC, based on input from the NEAD LLC Technical Advisory Committee (“TAC”), has drafted and approved the separate privacy and



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security plan for the NEAD that will be filed by the NEAD LLC with the FCC, in accordance with the Commission's rules.

The NEAD LLC is not only supported by ATIS, as the program manager, and West, as the primary technology vendor, but also a Technical Advisory Committee and a Steering Committee, both of which are comprised of key public safety and wireless industry participants. The structure of the NEAD LLC is modeled after the FCC Communications, Security, Reliability & Interoperability Council ("CSRIC") IV recommended structure for the 9-1-1 Location Technologies Test Bed ("Test Bed"). As the NEAD program manager, ATIS oversees and supports implementation of the NEAD platform by the technology vendor. Sprint, along with the other nationwide wireless carriers and public safety representatives participating in the NEAD working group and TAC, was instrumental in drafting specifications for the NEAD and the request for proposals for vendor selection to develop and operate the NEAD, as well as vetting various companies and their solutions to best determine the vendor selection recommendations. ATIS also provides support and coordination for NEAD project management, technical specifications and standards development, database operations and outreach to access point owners and administrators. The NEAD technical specifications and overall design are based on the standards independently developed by the ATIS Emergency Location ("ELOC") Task Force and working through the American National Standards Institute ("ANSI") accredited standards setting process.

The FCC recognized the joint commitment of the four nationwide wireless carriers, APCO and NENA to work collaboratively to establish and maintain the operational and technical functions of the NEAD. Therefore, the NEAD LLC receives advice and guidance from a Technical Advisory Committee ("TAC") and Steering Committee, both of which include members



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representing the wireless carriers and public safety associations. Through the NEAD LLC, the national wireless providers have funded the NEAD LLC's operations and administration, ATIS program management, as well as initial design, development and operation of the NEAD platform by West. With input from the NEAD LLC's Steering Committee, a cost sharing model is being developed to help ensure that ongoing NEAD costs are allocated equitably among providers who support or utilize the NEAD for Dispatchable Location solutions.

The NEAD platform is designed so that, when a call to 9-1-1 is placed from a wireless device equipped with Wi-Fi or Bluetooth, the wireless carrier network will automatically collect information from the wireless handset about nearby wireless access points. Many wireless devices in the marketplace today have the capability to identify the presence of access points within relatively close proximity. Such wireless access points contain Media Access Control ("MAC") addresses for Wi-Fi and Public Device Addresses ("PDA") for Bluetooth beacons, which can help identify the wireless access points. The wireless carrier networks can then query the NEAD platform to determine whether the MAC address or PDA of any wireless access points identified is in the database. If it is, it would typically be associated with a verified street address, plus any additional location information. The wireless carrier network would then determine, from the various sources of location data, including the location points within the NEAD, which information will provide the best possible location for the wireless 9-1-1 call to the appropriate PSAP.

Through a collaborative process including members of the public safety community and the wireless industry, ATIS ELOC is developing the necessary standards upon which NEAD design and technical specifications are based. Sprint, along with other wireless carriers, 9-1-1 service



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providers, public safety representatives, wireless device original equipment manufacturers (“OEMs”) and technology solutions vendors, is part of the membership of ELOC. In November 2016, ATIS released the standard that defines the architecture and requirements for the NEAD, as well as how information in the database is processed -- *Location Accuracy Improvements for Emergency Calls* (ATIS-0700028 v1.1). The contract that the NEAD LLC signed with its technology vendor contemplates development and implementation of the NEAD consistent with the new ATIS standard.

In accordance with ATIS-0700028, the NEAD platform has two components: the National Emergency Address Database (“NEAD”) and the National Emergency Address Manager (“NEAM”). As a component of the NEAD platform, the NEAD itself is the database of verified wireless access point street addresses, along with any additional relevant location information. The NEAD will be designed to respond only to requests for data from authorized wireless carriers attempting to route a 9-1-1 call. The NEAM is considered a set of systems to receive and process verified information for WiFi and Bluetooth wireless access points submitted for inclusion in the NEAD. The information will generally come from telecommunications service provider records of wireless access points, including MAC address and Bluetooth PDA location information, enterprise system records of WiFi and Bluetooth wireless access points, such as retail stores and hotels and individual consumers that provide location information voluntarily for wireless access points not already in the NEAD. The NEAM will be able to view and manage external sources of information for the submission of wireless access points on a public-facing website.

As discussed in more detail below, wireless carriers will test Dispatchable Location solutions in the 9-1-1 Location Technologies Test Bed to verify that NEAD information can be



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utilized to provide a Dispatchable Location consistent with the FCC regulations and technical parameters adopted by the ATIS ELOC in Annex D of ATIS-0700028. The ATIS Emergency Services Interconnection Forum ("ESIF") Emergency Services & Methodologies ("ESM") is also working on the methodology to run Dispatchable Location solutions through the Test Bed. The NEAD, along with requisite support by the wireless networks, must first be operational for testing of Dispatchable Location solutions to occur. Prior to wireless carriers utilizing the NEAD and Dispatchable Location solutions, they must certify that the information will only be used for 9-1-1 emergency purposes. The FCC must also formally approve the NEAD Privacy and Security Plan in accordance with Section 20.18(h)(3)(i)(4)(iii) of the Commission's rules. The NEAD Privacy and Security Plan will detail the administrative and operational functions of the NEAD to safeguard personal information and maintain a secure and resilient database.

The prospect of Dispatchable Location being provided to public safety during a wireless 9-1-1 call is relative to the number of wireless access points within the NEAD. Dispatchable Location solutions will eventually grow into ever-increasing stages of accuracy as different location solutions become more widely available and WiFi and Bluetooth wireless access points are continually entered into the NEAD. The FCC rules require that the NEAD house a certain minimum number of wireless access points in the top 50 Cellular Market Areas by 2023 equal to 25% of the particular CMA population. The national wireless carriers will submit information about WiFi and Bluetooth wireless access points they control and manage to the NEAD initially. The NEAD LLC and ATIS NEAD Outreach Manager have already begun to develop a strategy to encourage wireless access point owners and administrators, such as other broadband service providers, large enterprises and public institutions, to contribute such data to the NEAD in the



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interest of public safety. Stakeholders from industry, public safety and enterprises all need to be involved for the NEAD and Dispatchable Location solutions to be effective.

The FCC rules also require that the nationwide wireless carriers establish an independently administered and transparent indoor 9-1-1 location technologies Test Bed. The Test Bed is intended to verify how wireless 9-1-1 location technologies and solutions perform against the FCC's location accuracy requirements for wireless calls to 9-1-1 made from indoor locations. Similar to the NEAD, the four largest, nationwide wireless carriers worked with CTIA to fund and establish the 9-1-1 Location Technologies Test Bed, LLC ("Test Bed LLC") as an independent company to administer and operate the indoor Test Bed consistent with the FCC's rules. The Test Bed LLC then selected ATIS -- the Alliance for Telecommunications Industry Solutions -- as the Test Bed program manager. Sprint, along with the other national carriers and public safety representatives, as participants in the Test Bed working group and TAC, was instrumental in drafting specifications for the Test Bed based on the previously documented Test Bed process developed through CSRIC III in conjunction with the ESIF ESM. The working group developed the request for proposals for vendor selection to establish the Test Bed and testing procedures for the varying stages of testing to be conducted. The Test Bed LLC TAC along with CTIA oversight established the selection criteria for the Test Bed vendor, reviewing all applicants and their technology presentation. After vetting various companies and their solutions, Sprint and others provided recommendation to the Test Bed LLC for vendor selection. Following a competitive bidding process, the Test Bed LLC selected LCC Design Services (a Tech Mahindra Company) to administer and execute the Test Bed. The Test Bed LLC, like the NEAD LLC, is also modeled on the FCC CSRIC -- Communications, Security, Reliability & Interoperability Council -- methodology (CSRIC III) and organizational structure (CSRIC IV) recommendations. Testing



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specifications are independently developed by the ATIS ESIF -- Emergency Services Interconnection Forum -- including the ESIF ESM subcommittee through an ANSI accredited standards process.

ATIS ESIF also recommended how the Test Bed should be operated to facilitate orderly testing of wireless carriers and new technology vendors by having existing wireless carrier 9-1-1 location technologies tested in "Stage 1" and new technology vendor solutions tested in "Stage 2." Consistent with ATIS ESIF recommendations, indoor testing will also occur across the required four morphologies dictated by the Commission -- dense urban, urban, suburban and rural -- in two representative testing regions -- Atlanta, Georgia and San Francisco, California. ATIS, as Test Bed Program Manager, also provides guidelines on test building and test point selection and oversees implementation of the Test Bed by the Administrator. The Test Bed LLC receives advice and guidance from the TAC -- Technical Advisory Committee -- and Steering Committee made up of public safety and wireless industry participants.

The four nationwide wireless carriers provide funding for the Test Bed LLC administration and operation, as well as ATIS program management. Administrator support costs and other expenses related to the execution of the test methodology is provided by parties taking part in the testing, with input from the NEAD LLC's Steering Committee. The wireless carriers provided the funding for Stage 1 and technology solutions vendors provided funding for Stage 2.

ATIS ESIF develops the requisite test methodologies through a collaborative, multi-stakeholder process, inclusive of wireless carriers, 9-1-1 service providers, public safety representatives and technology solutions vendors. The *ATIS Standard on Test Bed and Monitoring Regions Definition and Methodology* (ATIS-0500031) provides the guidelines



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regarding test bed regions, morphologies, building types and construction materials. Indoor operational environments in real world 9-1-1 call scenarios that would be identified for testing include the four required morphologies -- Dense Urban, Urban, Suburban and Rural. Within each morphology there are commercial or residential use types and building categories, such as single family home, multi-family home, small office, large commercial or Arena, within the use types. Furthermore, within each building category, there are different building types, such as low rise, high rise, glass exterior, brick and stucco, for example. Each monitoring region was mapped to morphologies to be applied to the carrier-level cell site/sectors.

The Test Bed Administrator selected test points and various building candidates with review and approval by ATIS as the Test Bed LLC Program Manager with advice from the TAC based on the approaches initially established during CSRIC III and formalized in the test cases provided in ATIS-0500031. For the various building types in each morphology, buildings with sufficient variation were identified to capture the natural variation in architecture and construction materials when wireless 9-1-1 calls are made indoors. Twenty buildings were selected in each region for testing in each Test Bed stage consistent with the types outlined in the ATIS standard. For each building, a number of test points were identified that reflect the anticipated range of location performance variation within the building and generally span the different areas within the building from which a caller might place a call to 9-1-1. The number of test points identified within a building were determined based on the size and type of the building.

The Test Bed Administrator searched for and documented the various buildings and test points, while the Program Manager viewed and approved the selections. The specific buildings



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and test points were unknown to all test participants and testing began as ground truth surveys of the test points were completed. Both the Atlanta and San Francisco regions were tested in parallel using a standard configuration across all commercially-available wireless handsets tested, which helped ensure that the testing process was consistent across all participating carriers and potential errors or variable results were minimized. Common parameters were used for placing test calls at each test point during Stage 1, such as minimum number of calls, call duration and down time between calls. Testing was closely monitored by engineers from the Test Bed Administrator, ensuring that all testing was completed per the specifications within the Test Plan consistent with the ATIS standard. If data collected at a particular point did not meet all requirements and it was determined that a re-test was required, the testing occurred again at the same location.

Subsequent testing will focus on emerging location technologies, as well as Dispatchable Location solutions utilizing the NEAD and any available z-axis technologies. The testing results will allow wireless carriers to determine whether such technologies can be used to improve the performance of indoor wireless location accuracy for 9-1-1 and to develop a recommended z-axis metric under the FCC regulation. (*See 47 C.F.R. § 20.18(i)(2)(ii)(B)*).

Stage 1 testing consisted of utilizing existing technologies provided in commercially-available handsets, as well as 9-1-1 location technologies currently deployed in the networks of the nationwide wireless carriers. This included Advanced Forward Link Trilateration ("AFLT"), which uses downlink measured time & distance calculations, Assisted Global Positioning Satellite ("A-GPS"), including network provided assistance data for ephemeris and timing reference as the primary location method for 9-1-1 calls on wireless carrier networks, and Cell Identification/Cell



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Sector, which uses the serving cell site's location or sector for radio frequency coverage area to approximate the location of the device placing a 9-1-1 call. Data from Stage 1 indoor location performance testing will be used by wireless carriers to determine compliance with FCC regulation. The results from Stage 1 testing were kept confidential to the carrier or technology solutions vendor.

Overall, the traditional 9-1-1 outdoor location technologies tested in Stage 1 performed as expected indoors. A-GPS performed better in the urban, suburban and rural morphologies indoors than in the dense urban morphology. The nationwide wireless carriers will blend Stage 1 indoor location performance data with outdoor location performance data independently developed by a wireless carrier and apply the resulting performance metric to live call data, consistent with the FCC rulemaking. Section 8 of the ATIS standard (ATIS-050031) recommends the methodology carriers should use to blend Stage 1 indoor performance and outdoor performance data.

Test Bed Stage 2 involved testing emerging location technologies from four vendors and included Wi-Fi and A-GPS hybrid, WiFi-only, a device-based hybrid, and metropolitan beacon solutions combined with hybrid A-GPS. Testing was performed according to the same ATIS-defined methodology as Stage 1 per ATIS-0500031. Z-axis information was tested on a limited basis in Stage 2 of the Test Bed depending on the availability of information for a specific solution, region and morphology. Per *ATIS Guidelines for Testing Barometric Pressure-Based Z-Axis Solutions* (ATIS-0500030), a comprehensive z-axis specific field test is planned, subject to availability of commercial network handsets that include z-axis supporting technologies. The



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results of a comprehensive Z-axis specific field test will be evaluated and be used to propose z-axis accuracy metrics in accordance with FCC rules. (See 47 C.F.R. §20.18(i)(2)(ii)(B)).

Sprint has been very active in a significant number of industry standards activities as well as coordinating activities in support of the nationwide wireless carrier 9-1-1 indoor location accuracy obligations. The role of industry standards in the improvement of 9-1-1 indoor location accuracy has two main purposes. The first purpose is typical of many standards efforts in the wireless industry, which is to ensure consistency in network operational performance across carriers for the benefit of public safety. This is accomplished by having a common set of specifications and interfaces that vendors can use in development and support of the wireless carriers. It also helps reduce the number of varieties of interfaces which each carrier and PSAP needs to support for wireless networks to interface with Next Generation 9-1-1 selective routers, as well as the NEAD. The second area where industry standards play an important role for 9-1-1 indoor location accuracy improvement is to increase consistency of performance, customer experience and first responder experience in locating a 9-1-1 caller.

Dedicated staff represented Sprint in the key standards activities described below supporting industry's development of the elements of 9-1-1 indoor location accuracy improvement capabilities standards. Our Global Standards Department is part of the Chief Technology Officer's organization and has a focus on a number of core network standards areas, such as service requirements and cybersecurity, as well as many other regulatory obligations. Our Network Development team maintains overall subject matter expertise on 9-1-1 technologies and solutions, managing the highly technical engineering aspects of wireless network integration and deployment, selecting and managing vendors, developing regulatory



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reporting systems and processes, developing and implementing new technologies for the benefit of public safety.

The collective work on 9-1-1 indoor location accuracy improvements has occurred primarily within several technical working groups in two different standards organizations – ATIS and 3GPP - the 3rd Generation Partnership Program. ATIS develops technical standards for the United States and North American telecommunications industry and focuses on the technical aspects specific to that sector. Therefore, developing technical solutions to meet FCC regulatory obligations occupies a significant portion of the work within ATIS. For 9-1-1 location accuracy, much of the standards work occurs in ELOC and ESM. ELOC is responsible for developing the interface standards, functional decomposition, protocol and procedures for handling the technologies being utilized to improve 9-1-1 location determination, which includes reusing and enhancing existing protocols to support the new location technologies, as well as developing new protocols where existing protocols are insufficient. ESM is responsible for the performance metrics, test methodologies and common categorization (source codes) for 9-1-1 network deployments, establishing the morphologies within the six monitoring regions, including determination of Test Bed location requirements and blending of methodologies for assessing accuracy compliance.

3GPP is the international standards body which provides members with the environment to produce reports and specifications that define 3GPP technologies. 3GPP covers cellular telecommunications network technologies, including radio access, the core transport network, and service capabilities - including work on codecs, security, quality of service - and thus provides complete system, standards-based specifications. The specifications also provide for integration



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of non-radio access to the core network, and for interworking with Wi-Fi networks. The technologies covered by 3GPP include: GSM, UMTS, LTE, EPC and 5G. Working groups within 3GPP develop enhancements to support 9-1-1 location improvements. The 3GPP project, *Enhancing Location Capabilities for Indoor and Outdoor Emergency Communications*, had the objective to revise and enhance the existing requirements for emergency location services to incorporate the new FCC rules for improvement of indoor 9-1-1 location accuracy. Sprint led the initiative and obtained overwhelming support of member companies for the project and eventual approval by 3GPP.

Additionally, seven working groups were established by CTIA for oversight of all the work encompassed in establishing the NEAD and Test Bed and meeting the new FCC requirements. The working groups addressed the various areas of concern, including the Test Bed, the NEAD, Z-Axis, Standards, PSAP Implementation, DL Demonstration and NEAD Outreach. These working groups included active participation by Sprint and the other nationwide wireless carriers, as well as public safety representatives and wireless industry companies and organizations. A key accomplishment early in the process occurred when the Dispatchable Location working group worked with vendors to provide demonstrations of Dispatchable Location to public safety representatives. The Standards working group is co-chaired by Sprint with the important task of coordinating standardization of all the many elements in different standards groups within ATIS and 3GPP associated with the highly technical implementation of wireless 9-1-1 indoor location accuracy improvements, including Dispatchable Location. The PSAP Implementation working group, co-chaired by Sprint, is crafting the guidelines and related processes that will assist PSAPs in implementing location solutions that will include presentation of location data, such as Dispatchable Location, uncompensated barometric pressure data and z-axis for 9-1-1 calls. Sprint



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has also been an active participant in the CTIA 9-1-1 Location Accuracy Advisory Group established to help coordinate the common industry efforts supporting 9-1-1 location accuracy improvements.

As part of the first successfully completed scope of work, this cohesive working group consisting of primarily Public Safety Agency representatives, as well as NENA, APCO, Carrier and 911 Vendor representatives, ensured that all wireless carriers standardized confidence setting provided with uncertainty data with an emergency call to 90%.

Sprint is also working with wireless device OEMs, wireless network vendors and other wireless technology partners to develop more accurate and robust methods to deliver increasing accuracy for wireless 9-1-1 calls. Sprint has also been actively involved in industry efforts to improve the technological capability of wireless devices to acquire satellite signals, as well as time-to-first-fix and location accuracy, which have all seen improvements over the last several years. Sprint and the wireless industry as a whole has expended significant effort and expense to develop capabilities to support additional non-U.S. global navigation satellite systems ("GNSS"). If wireless devices in the United States are eventually authorized by the FCC to enable non-U.S. GNSS chipsets, utilizing an enhanced hybrid GPS solution, the number of satellites available for acquisition could double. This would greatly increase the opportunity for satellite-based technology improvements, especially in challenging environments, such as indoors or in dense urban environments where obtaining line-of-sight with multiple satellites is currently very challenging. As other global satellite constellations become available, more mature and reliable, there is an even greater opportunity for increased satellite acquisition and improved location accuracy. Sprint is also developing plans in support of device-based hybrid location solutions



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with GNSS Systems that could be used for more accurate PSAP routing, as well as faster and potentially more accurate position location delivery to PSAPs at the time a wireless 9-1-1 call is established. Emerging technologies, such as integrated device-based hybrid location solutions with GNSS Systems, hold great promise for improved indoor location accuracy in challenging environments.

Sprint has also implemented a plan to provide uncompensated barometric pressure data on future Voice over LTE (“VoLTE”) devices with the capability to detect and report the pressure reading. Sprint also plans to provide z-axis data on future VoLTE devices containing new z-axis technologies that are verified in the Test Bed to be compliant with the future z-axis metrics determined by independent organizations and approved by the Commission. It is unclear how PSAPs would use z-axis elevation values provided in feet or meters above sea level. The quality of z-axis/elevation value provided would be expected to be roughly the same level of accuracy as would be experienced with A-GPS horizontal accuracy, dependent upon satellite availability and geometry. Sprint will deliver uncompensated barometric pressure and z-axis data to NG9-1-1 routers technically capable of receiving it. Sprint’s implementation plans includes launch of future VoLTE devices capable of providing wireless access point signal data to the NEAD to determine if a Dispatchable Location is available. Sprint has formed a team to database wireless access point location reference data for its commercially-owned properties and Sprint-owned and operated public WiFi service areas. Sprint is working with its vendor for training and technical data requirements pertaining to populating the NEAD with Dispatchable Location reference points.



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Sprint's Product Development teams continually and routinely meet and work with wireless device OEMs to improve existing technology performance in support of wireless Phase II Enhanced 9-1-1, as well as the development of new technologies and solutions available in the wireless networks of tomorrow, including the NEAD. With 3GPP standardized solutions, such as the variety of location capabilities supported by Long Term Evolution ("LTE") positioning protocols and the associated extensions supporting Wi-Fi and Bluetooth crowd sourcing, Sprint expects to take full advantage of all available technologies when VoLTE service becomes commercially available on the Sprint nationwide wireless network. We are on a path toward having an all IP-based network capable of supporting VoLTE and, while we have not announced a timeframe for commercial deployment of VoLTE, we currently offer High Definition Voice over our very efficient code division multiple access ("CDMA") network. Sprint will not transition customers to VoLTE until we can match the great voice experience provided today. Sprint's largest investor, SoftBank, has deployed a VoLTE network in Japan, and we will leverage their expertise. Interoperability between national and international service providers is also key to ensuring a viable VoLTE ecosystem. Inter-carrier interoperability is a necessary prerequisite for our customers and public safety to have a seamless end-to-end voice and 9-1-1 experience.

Sprint's state-of-the-art, highly effective, handset-based Enhanced 9-1-1 CDMA assisted-GPS wireless network location accuracy solution is tried and true and complies with the current FCC rules and regulations pertaining to E9-1-1 location accuracy. We fully expect it will continue to do so into the future. As we begin to analyze, test and adopt ever-emerging technologies as part of our wireless network, including all available Dispatchable Location solutions, we anticipate being able to meet the future compliance deadlines established by the Commission.